

Brain Consequences of Early Trauma

What the science is telling us

David McCollum MD

Academy on Violence and Abuse

deeper understanding, better care.



It has become apparent in the past few years that adverse childhood experiences contribute to significant adverse consequences later in life. We are now beginning to understand the reasons why this is so. Recent research shows that the brain develops in a markedly altered fashion when exposed to adverse or abusive environments. This presentation is intended to provide a brief overview of how this occurs.

“Why can’t anyone figure out why I feel this way?”

A common question heard by many health care providers is “Why can’t anyone figure out why I feel this way?” The patient’s complaints are not easy to explain. Often multiple providers have gone through multiple xrays, scans, lab work, procedures - sometimes repeatedly - without finding a diagnosis. These scenarios are frustrating for both patient and provider.

First Recognized Patterns of Presentation in Practice Setting

Life Experiences Contributed to Medical Presentations

For myself, I started hearing stories about bad things happening in peoples’ lives when I first entered private practice in 1980. I encouraged patients to tell me how those experiences affected them. Soon, the patterns began to establish themselves. It became very clear that life experiences played themselves out in many medical presentations.

Vince Felitti’s Work

Supports Relationship Between Abuse and Medical Conditions

In order to understand why the relationship between harmful life experiences and ill health may be true, let’s first reflect on the work of Dr. Vince Felitti.

His work on the Adverse Childhood Experiences studies (ACEs) supports the relationship between abuse and many adult medical conditions.

The next slide depicts a number of graphs. The graphs will be presented quickly in an overlapping fashion. Rather than go into detail about each graph, I will just let you get the general idea. In every slide

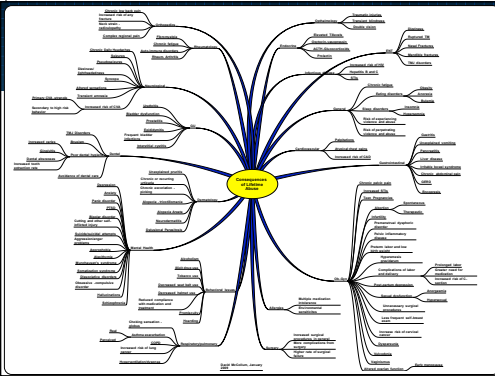
Childhood Experiences Underlie Rape



There is a consistent relationship between number of adverse childhood experiences and a host of adverse health related outcomes. The bottom line is that early childhood environment has a major impact on long term health, health-related behavior, longevity, and risk for future violence.

Consequences of Lifetime Experiences of Violence and Abuse

This comes from the ACE's studies, literature reviews, and the thousands of anecdotes from my practice. It is intended to show the wide ranging impact on health care as a result of any lifetime exposure to violence.

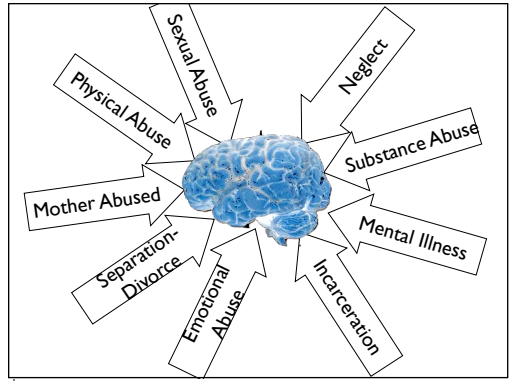


Why Does This Happen?

Despite all of this, the question remains - why does this happen?
Is there a good explanation to support what seems to be the case?

This is where the new evidence on brain development comes in to play. Science now shows us what happens to brains when people are exposed to repeat trauma and other stressful events.

Anatomic Background



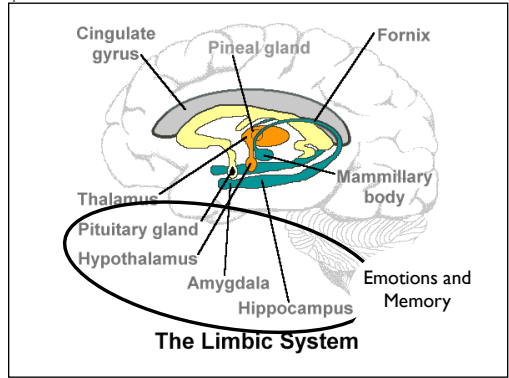
We've already detailed the various adverse childhood experiences. Now we will look at how these experiences change the brain itself.

Areas Affected by Adverse Experiences

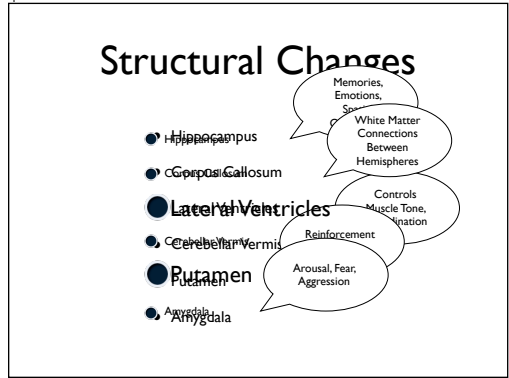
Areas of the brain affected by adverse experiences are:

- Limbic System
- HPA axis
- Corpus Callosum
- Cerebellar Vermis
- Prefrontal Cortex
- Ventricles
- Brainstem
- Temporal Lobe

The limbic system
 The hypothalamic - pituitary- adrenal or HPA axis.
 The corpus callosum
 The cerebellar vermis
 the Prefrontal cortex
 The ventricles
 The brainstem
 AND the temporal lobes

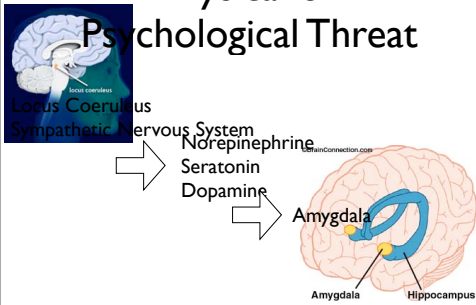


The limbic system is made up of several components in the brain. Together, they are involved in emotions, motivation, and emotional association with memory. We will focus on the components outlined in red.

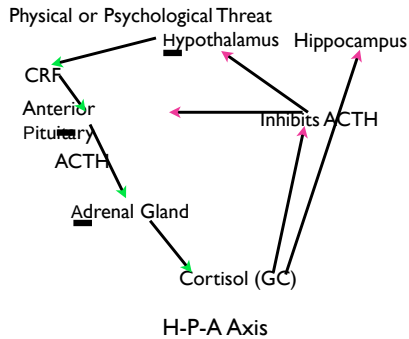


Through specialized MRI techniques and other new measuring methods, we see changes in the following:
 The hippocampus, again which deals with memories, emotions, and spatial orientation,
 The corpus callosum, which is the white matter connections between the hemispheres of the brain - essentially providing communications between the two sides.
 The lateral ventricles are simply fluid filled spaces that help to provide cushioning for the brain and production of spinal fluid.
 The cerebellar vermis controls muscle tone and coordination.

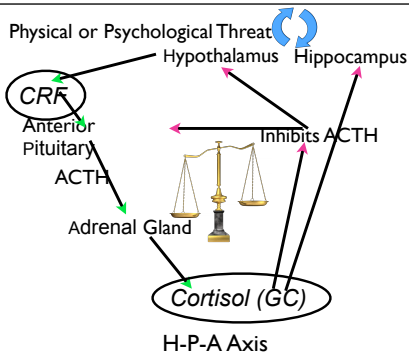
Physical or Psychological Threat



The locus coeruleus is in a very primitive part of the brain. When the individual experiences a sense of physical or psychological threat, it is the locus coeruleus that is involved in the initial response. It stimulates the sympathetic nervous system, which in turn signals the limbic system, in particular the amygdala, through the neurotransmitters, norepinephrine, serotonin and dopamine.



These stimuli are then passed to the hypothalamus which initiates a series of hormonal stimuli with feedback mechanisms, which together are referred to as the hypothalamic-pituitary-adrenal axis - abbreviated HPA



Under continuous or frequently repeated threats, CRF remains high. Therefore Cortisol remains high. The inhibitory pathway become numbed and the system is thrown out of balance.

Elevated Glucocorticoids-

- Inhibit myelination
- Delay maturation of brain structures
- Reduce synaptic connections and dendritic proliferation
- Pruning of neurons

Persistent elevated glucocorticoids leads to

- Inhibition to myelination which is what establishes the stability of the nerves of the brain
- brain maturation is delayed
- the rich synaptic connections and dendritic proliferation is blunted
- pruning of the neurons is latered

What Have We Found?

- Increased electrophysiological abnormalities in left fronto-temporal region
- Higher prevalence of ictal temporal lobe epilepsy-like symptoms
- Abnormally elevated left hemisphere EEG coherence
- Reduced volume of left hippocampus
- Smaller corpus callosum
- Alterations of cerebellar vermis
- Abnormalities in cortical size, symmetry, and neuronal density
- Highly lateralized hemispheric responses to memory recall

Hormones Affected

- Hypothalamic-Pituitary-Adrenal Axis
- CRF - Corticotropin Releasing Factor
- AVP
 - *Arousal and CNS Activation
 - *Anxiogenesis
- ACTH
 - *Appetite Suppression
 - *GI Motility and Gastric Emptying
- Glucocorticoids
 - *Vasodilation
 - *Uterine Contractions
 - *Cardiac Inotropism
- Serotonin
- Substance P

CRF plays several roles beyond the basic stimulation of ACTH:

-

Chronic Stress and Dopamine

- Overproduction
- Reduced attention
- Increased overall vigilance
- Reduced capacity to learn new material
- Increasing paranoia and psychotic behavior

Serotonin and Chronic Stress

- Stimulates both anxiogenic and anxiolytic pathways
- Decreased levels in prefrontal cortex
- Suicidal behavior, depression, and aggression

Amygdala

- Results in deficits in oxytocin, early menopause
- Sexual aggression, dissatisfaction, IPV and impaired pair bonding



Sean is a 21 yo male who is listed as permanently disabled by his chronic fatigue, fibromyalgia, panic disorder. when I asked him what had happened to him when he was little, he said he didn't know but his uncle was in prison for whatever he had done.

Vince Felitti wrote an article about turning gold into lead and that's exactly what happens when we do not protect our children from abuse and when we refuse to believe their stories and we fail to give them comfort and security



- Pain response tends to be exaggerated
- This is NOT a choice that patients make
- The professional response needs to reflect that understanding

- Chronic Fatigue Syndrome
- PTSD and Panic Disorders
- Depression and Suicidality
- Addictive behavior
- Eating Disorders
- Fibromyalgia
- Chronic Pain Syndromes
- Dissociative Disorders
- Schizophrenia
- Rheumatoid Arthritis
- Asthma

Can We Do Something?

- SSRI's→ACTH and Cortisol Normalized
- Dilantin
- Propranolol
- Misoprostol
- Ketamine
- Cognitive Behavioral Therapy
- CRF inhibitors

Translation to Practice

[Read J. van Os J. Morrison AP. Ross CA.](#)

Childhood trauma, psychosis and schizophrenia: a literature review with theoretical and clinical implications.

Acta Psychiatr Scand. 2005 Nov;112(5):330-50. Review.

“...that psychological approaches are more effective than medication for psychotic people who suffered childhood trauma.”

“Simply making a connection between their life history and their previously incomprehensible symptoms may have a significant therapeutic effect.”

“All ~~mental~~ health services should establish policy guidelines for how and when to ask about trauma in general, including child abuse.”